AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions, and listings, of claims in the application.

Claim 1 (Cancelled)

2. (Currently Amended) ~~The~~ A knocking detection apparatus ~~of claim 1, wherein the~~ comprising:

spark plugs disposed in cylinders of an internal combustion engine;

ion current detecting means for detecting ion currents flowing in the spark plugs;

time-frequency transforming means ~~uses~~ for, within time intervals, allowing at least one overlap of respective intervals, from a time after ignition by one of the spark plugs until the spark plug in the respective cylinder or in another cylinder next ignites, sampling the ion currents in the respective time intervals and determining frequency components of the ion currents sampled using a ~~fast~~ short-time Fourier transform ~~to determine the frequency components~~.

3. (Currently Amended) ~~The~~ A knocking detection apparatus ~~of claim 1, wherein the~~ comprising:

spark plugs disposed in cylinders of an internal combustion engine;

ion current detecting means for detecting ion currents flowing in the spark plugs;

time-frequency transforming means ~~uses~~ for, within time intervals, allowing at least one overlap of respective intervals, from a time after ignition by one of the spark plugs until the spark plug in the respective cylinder or in another cylinder next ignites, sampling the ion currents in the respective time intervals and determining frequency

components of the ion currents sampled using a Gabor wavelet transform ~~to determine the frequency components~~.

4. (Currently Amended) The knocking detection apparatus of claim ~~1~~ 2, wherein the knocking detecting means detects occurrence of knocking and timing of knocking occurrence.

5. (Currently Amended) The knocking detection apparatus of claim ~~1~~ 2, wherein the detection control means changes at least one of (i) sampled times where the time-frequency transforming means samples ion currents in accordance with the running status of the internal combustion engine and (ii) ion current sample number serving as a target of time-frequency transformation.

6. (Currently Amended) The knocking detection apparatus of claim ~~1~~ 2, wherein resistance with respect to impulse noise and ion current intensity changes indicating knocking is raised by dividing, by a standardizing factor, a knocking determination equation that the knocking detecting means computes.

Claim 7 (Cancelled).

8. (Currently Amended) ~~The~~ A knocking detection method ~~of claim 7,~~ including:

detecting ion currents using spark plugs disposed in cylinders of an internal combustion engine;

setting time intervals, allowing at least one overlap of respective intervals within a time from after ignition by one of the spark plugs until the spark plug in the respective cylinder or in another cylinder next ignites;

sampling the ion currents in the respective time intervals, time-frequency transforming the ion currents sampled, and determining frequency components of the ion currents; and

detecting knocking based on the frequency components of the ion current samples and running status of the internal combustion engine, and controlling the time-frequency transforming to determine the frequency components of the ion currents sampled using a ~~fast~~ short-time Fourier transform.

9. (Currently Amended) ~~The~~ A knocking detection method ~~of claim 7,~~ including:

detecting ion currents using spark plugs disposed in cylinders of an internal combustion engine;

setting time intervals, allowing at least one overlap of respective intervals within a time from after ignition by one of the spark plugs until the spark plug in the respective cylinder or in another cylinder next ignites;

sampling the ion currents in the respective time intervals, time-frequency transforming the ion currents sampled, and determining frequency components of the ion currents; and

detecting knocking based on the frequency components of the ion currents sampled and running status of the internal combustion engine, and controlling the time-frequency transforming to determine the frequency components of the ion currents sampled using a Gabor wavelet transform.

10. (Currently Amended) The knocking detection method of claim ~~7~~ 8, including detecting occurrence of knocking and the timing of knocking occurrence.

11. (Currently Amended) The knocking detection method of claim ~~7~~ 8, including changing at least one of (i) sampled times while sampling ion currents in

accordance with the running status of the internal combustion engine and (ii) ion current sample number serving as a target of the time-frequency transforming.

12. (Currently Amended) The knocking detection method of claim ~~7~~ 8, including raising resistance to impulse noise and ion current intensity changes by dividing, by a standardizing factor, a knocking determination equation used in detecting knocking.

13. (New) The knocking detection apparatus of claim 3, wherein the knocking detecting means detects occurrence of knocking and timing of knocking occurrence.

14. (New) The knocking detection apparatus of claim 3, wherein the detection control means changes at least one of (i) sampled times where the time-frequency transforming means samples ion currents in accordance with the running status of the internal combustion engine and (ii) ion current sample number serving as a target of time-frequency transformation.

15. (New) The knocking detection apparatus of claim 3, wherein resistance with respect to impulse noise and ion current intensity changes indicating knocking is raised by dividing, by a standardizing factor, a knocking determination equation that the knocking detecting means computes.

16. (New) The knocking detection method of claim 9, including detecting occurrence of knocking and the timing of knocking occurrence.

17. (New) The knocking detection method of claim 9, including changing at least one of (i) sampled times while sampling ion currents in accordance with the running status of the internal combustion engine and (ii) ion current sample number serving as a target of the time-frequency transforming.

18. (New) The knocking detection method of claim 9, including raising resistance to impulse noise and ion current intensity changes by dividing, by a standardizing factor, a knocking determination equation used in detecting knocking.